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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/742,695	12/19/2003	Shaz Qadeer	3382-66774-01	4372

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EXAMINER
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ALHUA, SAIF A

ART UNIT	PAPER NUMBER
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2128

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/08/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

**Office Action Summary**

Application No.

10/742,695

Applicant(s)

QADEER ET AL.

Examiner

Saif A. Alhija

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 19 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |                                                                                        |                                                                   |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>12/19/03, 6/7/04</u> .                                        | 6) <input type="checkbox"/> Other: _____                          |

**DETAILED ACTION**

1. Claims 1-20 have been presented for examination.

**Information Disclosure Statement**

2. i) The information disclosure statement (IDS) submitted on 19 December 2003 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the Examiner has considered the IDS' as to the merits.

ii) The information disclosure statement filed 7 June 2004 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered. NPL documents for Hoare, Milner, and Roscoe have not been provided.

**Claim Objections**

3. **Claim 2 is objected** to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 2 appears to be an independent claim in dependent form.

**Claim Rejections - 35 USC § 101**

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

**MPEP 2106 recites:**

The claimed invention as a whole must accomplish a practical application. That is, it must

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produce a "useful, concrete and tangible result" State Street 149 F.3d at 1373, 47 USPQ2d at 1601-02. A process that consists solely of the manipulation of an abstract idea is not concrete or tangibles. See *In re Warmerdam*, 33 F.3d 1354, 1360, 31 USPQ2d 1754, 1759 (Fed.Cir. 1994). See also *Schrader*, 22 F.3d at 295, 30 USPQ2d at 1459.

4. **Claims 1-20 are rejected** under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

i) The claims recite identifying actions, generating summaries, indications, and model evaluations. These appear to be abstract steps and as such the claims do not produce a useful, concrete, and tangible result.

ii) The claims also explicitly state software elements as well as data structures. As such the claims are drawn to a computer program and data manipulation which does not produce a useful, concrete, and tangible result. For example, claim 19 states computer media encoded with a data structure containing state pairs, which falls under mere data manipulation.

iii) The claims recite a computer program. It should be noted that code (i.e., a computer software program) does not do anything per se. Instead, it is the code stored on a computer that, *when executed*, instructs the computer to perform various functions. The following claim is a generic example of a proper computer program product claim;

A computer program product embodied on a computer-readable medium and comprising code that, when executed, causes a computer to perform the following:

Function A  
Function B  
Function C, etc...

Appropriate correction is required.

All claims dependent upon a rejected base claim are rejected by virtue of their dependency.

**Claim Rejections - 35 USC § 112**

**The following is a quotation of the second paragraph of 35 U.S.C. 112:**

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**5. Claims 1-20 are rejected** under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

i) Claim 1 recites a “partial procedure summary.” It is unclear what is meant by this phrase. Are there conditions which must be followed in order to create a partial procedure summary? The claim merely states generating a summary from a procedure but no steps are provided to indicate how the summary is created, what it specifically contains, etc. This renders the claim vague and indefinite.

ii) Claim 4 recites “the modeled state fails the indicated state invariant.” It is unclear how the model fails? The comparison recited in the claim does not indicate what type of resultant would be produced nor what type of comparison is made. Further, it is unclear how a programming flaw is presented. This phrase renders the claim vague and indefinite.

iii) Claim 5 recites “initial location” and “resulting location.” It is unclear if these locations are arbitrary or relevant to the partial procedure summary. Further, it is unclear if these locations are part of the partial procedure summary. If so, how and when are they provided to the partial procedure summary? These phrases render the claim vague and indefinite.

iv) Claim 6 recites “consulting a procedure summary.” It is unclear what is mean by consulting? Does the partial procedure summary contain the necessary instructions to perform the required limitation or is it merely part of a broader framework? In the latter case, where is the broader framework mentioned which would allow for utilization of the partial procedure summary? The claim merely recites consulting the summary and renders the claim vague and indefinite.

v) Claim 10 recites “proper subset.” It is unclear what is meant by a proper subset as opposed to an improper subset. This renders the claim vague and indefinite.

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vi) Claim 11 recites “evaluating actions.” It is unclear what is meant by evaluating actions? In what context are the actions evaluation? Through what mechanism, a user or automated program for example, are the actions evaluated? This renders the claim vague and indefinite.

vii) Claim 11 recites “wherein the procedure summaries model states of the multithreaded software for multithreaded execution of the multithreaded software.” The Examiner is confused by the meaning of this limitation. It is unclear what is being modeled? What type of state of the multithreaded software is modeled? Is the software modeled during execution or absent execution? This renders the claim vague and indefinite.

viii) Claim 15 recites “a model checked operable to analyze a model.” It is unclear how the model is analyzed. Further the claim appears to state that the model checker analyzes a model. However the model checker is defined in the claim to be a model of software. This would be interpreted as a model analyzing another model. This renders the claim vague and indefinite.

ix) Claim 19 states “one or more computer readable media.” It is unclear if the claim limitations are contained on a single media or on multiple medias. In the case of multiple medias there does not appear to be a framework to allow the separate media to interact in order to perform the needed limitations. This renders the claim vague and indefinite.

Appropriate correction is required.

All claims dependent upon a rejected base claim are rejected by virtue of their dependency.

**Claim Rejections - 35 USC § 102**

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. **Claims 1-20 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Tyrrell et al.**

**“CSP Methods for Identifying Atomic Actions in the Design of Fault Tolerant Concurrent Systems”, hereafter Tyrrell.**

**Regarding Claim 1:**

**The reference discloses** A method of generating a partial procedure summary of a procedure of multithreaded software, wherein the procedure performs a plurality of actions when executed, the method comprising:

identifying a plurality of the actions as atomically modelable with respect to multithreaded execution of the procedure; **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Figure 1-2)**

generating the partial procedure summary of the procedure from the plurality of the actions atomically modelable with respect to multithreaded execution of the multithreaded software. **(Page 633, Figure 3-4. Parallel processing and interleaving summaries)**

**Regarding Claim 2:**

**The reference discloses** One or more computer-readable media having computer-executable instructions for performing the method of claim 1. **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Figure 1-2)**

**Regarding Claim 3:**

**The reference discloses** The method of claim 1 further comprising:

modeling execution of the software via the partial procedure summary. (Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Figure 1-2)

**Regarding Claim 4:**

**The reference discloses** The method of claim 3 further comprising:

during modeling, comparing an indicated state invariant with a modeled state; (Figure 1-2. Page 630, Left Column, Paragraph 2, “Thus all processes in the atomic action cooperate in error detection.”)

responsive to determining the modeled state fails the indicated state invariant, indicating that a programming flaw is present in the software. (Page 630, Left Column, Paragraph 2, “Thus all processes in the atomic action cooperate in error detection.”)

**Regarding Claim 5:**

**The reference discloses** The method of claim 1 further comprising:

associating an initial location and a resulting location within the procedure with partial procedure summary. (Page 630, Section II, Left Column, Last Paragraph, Boundaries and entry/exit lines)

**Regarding Claim 6:**

**The reference discloses** The method of claim 1 further comprising:

performing a reachability analysis of the software; (Page 630, Right Column, Section III, First Paragraph, Reachability Graph/Petri Net) and



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consulting a procedure summary comprising the partial procedure summary the procedure is encountered during the reachability analysis. **(Page 630, Right Column, Section III, First Paragraph, Reachability Graph/Petri Net)**

**Regarding Claim 7:**

**The reference discloses** The method of claim 1 wherein the identifying comprises identifying a transaction boundary within the actions. **(Page 630, Section II, Left Column, Last Paragraph, Boundaries)**

**Regarding Claim 8:**

**The reference discloses** The method of claim 1 wherein the identifying comprises identifying at least one of the plurality of actions as movable later in time with respect to actions executed by other threads without affecting a resulting end state. **(Page 631, Left Column, Paragraph 3, Timelines and Time Critical Systems)**

**Regarding Claim 9:**

**The reference discloses** The method of claim 1 wherein the identifying comprises identifying a sequence of actions having zero or more right movers followed by an atomic action followed by zero or more left movers. **(Page 630, Section II, Left Column, Last Paragraph, Atomic Actions. Page 632-634, Algorithms/Interleaving and Elements S/F/K)**

**Regarding Claim 10:**

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**The reference discloses** The method of claim 1 wherein the plurality of actions atomically with respect to multithreaded execution of the software is a proper subset of the plurality of actions of the procedure. **(Page 632-634, Algorithms/Interleaving and Elements S/F/K)**

**Regarding Claim 11:**

**The reference discloses** A method of modeling multithreaded software, the method comprising:

evaluating actions of the multithreaded software; **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Page 633, Figure 3-4. Parallel processing and interleaving summaries. Figure 1-2)** and

based on the evaluating, generating a plurality of procedure summaries for the multithreaded software; **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Page 633, Figure 3-4. Parallel processing and interleaving summaries. Figure 1-2)**

wherein the procedure summaries model states of the multithreaded software for multithreaded execution of the multithreaded software. **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Page 633, Figure 3-4. Parallel processing and interleaving summaries. Figure 1-2)**

**Regarding Claim 12:**

**The reference discloses** The method of claim 11 wherein at least one of the procedure summaries comprises at least two or more partial procedure summaries summarizing a procedure. **(Page 633, Figure 3-4. Parallel processing and interleaving summaries.)**

**Regarding Claim 13:**

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**The reference discloses** The method of claim 11 wherein at least one of the procedure summaries comprises at least one partial procedure summary for a procedure, wherein the partial procedure summary summarizes less than all of the procedure. **(Claim Interpretation. A summary by definition is less than what it summarizes. Page 633, Figure 3-4. Parallel processing and interleaving summaries.)**

**Regarding Claim 14:**

**The reference discloses** The method of claim 11 wherein the evaluating comprises:  
identifying a series of transactions within the multithreaded software; **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Page 633, Figure 3-4. Parallel processing and interleaving summaries. Figure 1-2) and**  
modeling the transactions via partial procedure summaries. **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Page 633, Figure 3-4. Parallel processing and interleaving summaries. Figure 1-2)**

**Regarding Claim 15:**

**The reference discloses** A system for modeling multithreaded software, the system comprising:  
a model checker operable to analyze a model of the multithreaded software, the model checker comprising: **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Page 633, Figure 3-4. Parallel processing and interleaving summaries. Figure 1-2)**  
a model of the software, wherein the model comprises a plurality of procedure summaries modeling states of the software during multithreaded execution of the multithreaded software. **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Page 633, Figure 3-4. Parallel processing and interleaving summaries. Figure 1-2)**

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**Regarding Claim 16:**

**The reference discloses** The system of claim 15 wherein at least one of the procedure summaries comprises a procedure summary summarizing actions deemed to have occurred one after another without interruption. **(Claim Interpretation. Actions occurring without interruption is the definition of an atomic action. Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Figure 1-2)**

**Regarding Claim 17:**

**The reference discloses** The system of claim 15 wherein the model checker further comprises:

a reachability analyzer operable to employ the procedure summaries to generate modeled states of the software. **(Page 630, Right Column, Section III, First Paragraph, Reachability Graph/Petri Net**

**Regarding Claim 18:**

**The reference discloses** system of claim 17 wherein the system is operable to detect programming flaws via comparing an indicated state invariant with the modeled states. **(Page 630, Left Column, Paragraph 2, “Thus all processes in the atomic action cooperate in error detection.”)**

**Regarding Claim 19:**

**The reference discloses** One or more computer-readable media having encoded thereon a data comprising:

a plurality of state pairs representing a procedure summary for multithreaded software, wherein at least one of the state pairs comprises an initial state and a resulting state indicating a state after execution of actions modeled by the procedure summary, wherein the procedure summary models multithreaded execution of the multithreaded software. **(Figure 2, State Space Diagram)**

**Regarding Claim 20:**

**The reference discloses.** The one or more computer-readable media of claim 19 wherein the state pairs comprise the following:

an indication of a first location within the procedure and an indication of a possible state for one or more variables of the multithreaded software when the procedure has reached the first location; and **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Page 633, Figure 3-4. Parallel processing and interleaving summaries. Figure 1-2)**

an indication of a second location within the procedure and an indication of a resulting state for the one or more variables of the multithreaded software after a plurality of summarized actions of the procedure have been executed, wherein the summarized actions start at the first location and end at the second location; **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Page 633, Figure 3-4. Parallel processing and interleaving summaries. Figure 1-2)**

wherein the plurality of summarized actions of the procedure are atomically modelable with respect to multithreaded execution of the multithreaded software. **(Page 630, Section II, Left Column, Last Paragraph, Concurrent Systems and Atomic Actions. Page 633, Figure 3-4. Parallel processing and interleaving summaries. Figure 1-2)**

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Conclusion

7. All Claims are rejected.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Saif A. Alhija whose telephone number is (571) 272-8635. The examiner can normally be reached on M-F, 11:00-7:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571) 272-2279. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SAA

March 3, 2007

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TECHNOLOGY CENTER 2100